

REMARKS

Reconsideration and allowance of this application, as amended, is respectfully requested.

Briefly, the present invention is directed to an improved arrangement for preventing wire disconnection in a case of connecting a conductive connecting member to a connected member, wherein wire disconnection is likely to occur because of high temperatures to which the connection member and connected member are subjected. One example of an arrangement in which the present invention is useful is shown, for example, in the completed product of Fig. 26 regarding a resin encapsulated semiconductor chip 18. Specifically, as shown in Fig. 26, the semiconductor chip 18 is connected to an inner portion 4 of a lead by wire 19. The inner portion is plated with a metal layer 1 which includes a palladium layer. The semiconductor device 18 is mounted on a die pad 2 of a lead frame 7 (e.g., see Figs. 11 and 12) utilizing an adhesive layer 15 (e.g., see Fig. 15 for an example of the adhering process). In accordance with the present invention, an alloy layer 5, having the melting point higher than that of a solder having Pb as a main composition metal, is formed on a portion of the lead outside of the resin 24. This alloy layer contains no Pb and no Pd as a main composing metal (e.g., see page 30, line 25 – page 31, line 13, as well as page 7, line 23 – page 8, line 10).

As a result of this overall structure, the problem of wire disconnection is avoided, while cost reduction is achieved, as discussed on pages 7 and 8.

Reconsideration and removal of the claim objections and the 35 U.S.C. 112, second paragraph, rejection with regard to claims 2-7, 9 and 10 is respectfully requested. Each of the claims 2-7, 9 and 10 has been amended to specifically

address the various points of objection and rejection raised on pages 2 and 3 of the Office Action. As such, the term “a melting point” has been changed to “the melting point” in light of the first paragraph of the claim objection. Claims 9 and 10 have been amended to define a mounting substrate structure to avoid the potential confusion noted in the second paragraph of the claim objection. As such, the mounting substrate structure includes a semiconductor integrated circuit device and a printed circuit board, as shown, for example, in the examples provided in Figs. 28 and 29.

With regard to the 35 U.S.C. 112, second paragraph, rejections, the various phrases objected to as lacking antecedent basis have each been amended to provide clear antecedent basis. The term “to be connected” has been changed. Also, the phraseology of each of the claims has been amended to clearly identify first and second portions, or an inner lead portion and an outer lead portion, to clarify the questions raised in the 35 U.S.C. 112, second paragraph, rejection regarding this. Also, the language has been amended regarding the phraseology concerning Pb and Pd. In light of these amendments of claims 2-7, 9 and 10, it is respectfully submitted that the claims meet the requirements of 35 U.S.C. 112, for clearly defining the invention, and reconsideration and removal of these rejections is respectfully requested.

Reconsideration and removal of the 35 U.S.C. 102(b) rejection of claims 1-10 as being anticipated by Kinghorn (USP 5,635,755) is also respectfully requested. By the present amendment, each of claims 2-7, 9 and 10 clearly defines that the alloy layer or the metal layer formed in the second portion of the connected member, or the outer lead portion, contains neither Pb nor Pd as a main composing metal. It is respectfully submitted that Kinghorn fails to teach or suggest any such arrangement

in which a second portion of the connected member, other than the first portion connected to the connecting member, contains neither Pb nor Pd. On the contrary, referring to Fig. 7 of Kinghorn, for example, it is quite clear that the palladium layer 44 is located both in the first portion, molded by the resin 54, to which the wire 52 is connected and in the second portion of the lead outside of the resin molding. Therefore, the structure of Kinghorn is significantly different than that of the present claimed invention by virtue of the fact that the palladium layer 44 is provided in the equivalent of both the first and second portions (or the inner and outer lead portions) of the lead 12.

New dependent claims 18-25 even further emphasized this distinction by clearly setting forth that the palladium layer is not provided at said second portion (or said outer lead portion) of the connected member outside of the resin. As noted above, Kinghorn clearly does provide the palladium layer 44 in the lead portion outside of the resin, and, as such, is structurally quite different than the claimed invention.

For the reasons set forth above, it is respectfully resubmitted that amended claims 2-7, 9 and 10, as well as claims 18-25 clearly define over Kinghorn, and reconsideration and allowance of these claims is respectfully requested.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is captioned "Version with markings to show changes made."

If the Examiner believes that there are any other points which may be clarified or otherwise disposed of, either by telephone discussion or by personal interview, the Examiner is invited to contact applicants' undersigned attorney at the number indicated below.

To the extent necessary, the applicants petition for an extension of time under 37 CFR 1.136. Please charge any shortage in the fees due in connection with the filing of this paper, including extension of time fees, to the deposit account of Antonelli, Terry, Stout & Kraus, Deposit Account No. 01-2135 (500.39590X00).

Respectfully submitted,

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By



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VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Claims:

Claims 1, 8 and 11-15 have been cancelled without prejudice.

Claims 2-7, 9 and 10 have been amended as follows:

2. (Amended) A semiconductor integrated circuit device comprising:
- a conductive connecting member [having a conductivity];
 - a connected member in which a metal layer including a palladium layer is provided at a first portion to which said connecting member is connected, and an alloy layer is provided having [a] the melting point higher than that of a solder having Pb as a main composition metal, [and] wherein said alloy layer [containing] contains no Pb and no Pd as a main composing metal [is provided at a portion outside a portion molded by a resin]; and
 - a resin molding said connected first portion[.],
 - wherein said alloy layer is provided at a second portion of said connected member outside of said resin.

3. (Amended) A semiconductor integrated circuit device comprising:
- a conductive connecting member [having a conductivity];
 - a connected member in which a metal layer including a palladium layer is provided at a first portion to which said connecting member is connected, and a metal layer is provided having [a] the melting point higher than that of an Sn-Pb eutectic solder, [and] wherein said metal layer [containing] contains no Pb and no Pd as a main composing metal [is provided at a portion outside a portion molded by a

resin]; and

a resin molding said connected first portion[.],

wherein said metal layer is provided at a second portion of said connected member outside of said resin.

4. (Amended) A semiconductor integrated circuit device comprising:

a conductive connecting member [having a conductivity];

a connected member in which a metal layer including a palladium layer is provided at a first portion to which said connecting member is connected, and a Pb-layer, having [a] the melting point higher than Sn-Pb eutectic solder, [and] wherein said Pb-free metal layer [containing] contains no Pd as a main composing metal [is provided at a portion molded by a resin]; and

a resin molding said connected first portion[.],

wherein said Pb-free metal layer is provided at a second portion of said connected member outside of said resin.

5. (Amended) A semiconductor integrated circuit device

comprising:

a semiconductor chip;

a conductive connecting member connected to said semiconductor chip [and having a conductivity];

a connected member in which a metal layer including a palladium layer is provided at a first portion to which said connecting member is connected, and a Pb-free metal layer having [a] the melting point higher than that of an Sn-Pb eutectic solder, [and] wherein said Pb-free metal layer [containing] contains no Pd as a main

composing metal, wherein said Pb-free metal layer is provided in [the other] a
second [portions] portion of the connected member other than said first portion; and

a resin molding [a portion of] said semiconductor chip connected to said
connecting portion, said connecting member and [a] said first portion of said
connected portion to which said connecting member is connected.

6. (Amended) A semiconductor integrated circuit device comprising:

a semiconductor chip;

a wire bonded to said semiconductor chip;

a lead including an inner lead portion and an outer lead portion, wherein [in
which] a metal layer including a palladium layer is plated on [a portion in an] said
inner lead portion and is bonded [by] to said wire, and wherein a Pb-free alternate
solder₁ having [a] the melting point higher than that of an Sn-Pb eutectic solder₁ and
which Pb-free alternate solder [containing] contains no Pd as a main composing
metal₁ is plated on a mounted portion of [an] said outer lead portion; and

a resin molding a bonding portion of said semiconductor chip to which said
wire is bonded, said wire and the inner lead portion of said lead [including a portion]
to which said wire is bonded.

7. (Amended) A semiconductor integrated circuit device comprising:

a semiconductor chip;

a wire;

a resin molding said semiconductor chip and

said wire; and

a lead in which a metal layer including a palladium layer is provided in a front

end [of a] portion of said lead molded by said resin, and a Pb-free metal layer,
having [a] the melting point higher than an Sn-Pb eutectic solder, [and] which Pb-free
metal layer [containing] contains no Pd as a main composing metal, is provided [in a
portion outside a] at an outer portion of said lead which is not molded by said resin.

9. (Amended) A mounting substrate structure comprising:

a semiconductor integrated circuit device, said semiconductor integrated
circuit device being provided with a conductive connecting member [having a
conductivity], a connected member in which a metal layer including a palladium layer
is provided at a first portion to which said connecting member is connected, and an
alloy containing no Pb and no Pd as a main composing metal is provided in a second
portion of said connected member [outside a portion molded by a resin], and a resin
molding said first portion of said connected member to be connected; and

a printed circuit board,

wherein said semiconductor integrated circuit device is connected to said
printed circuit board by a solder having [a] the melting point higher than that of [the] a
solder having Pb as a main composing metal[.]and

wherein said second portion of said connected member is outside of said
resin.

10. (Amended) A mounting substrate structure comprising:

a semiconductor integrated circuit device, said semiconductor integrated
circuit device being provided with a conductive connecting member [having a
conductivity], a connected member in which a metal layer including a palladium layer
is provided at a first portion to which said connecting member is connected, and a

metal containing no Pb and no Pd as a main composing metal [outside] at a second portion [molded by a resin], and a resin molding said first portion of said connected member to be connected to said connecting member; and

a printed circuit board to which said semiconductor integrated circuit device is connected by a metal having [a] the melting point higher than that of [the] a solder having Pb as a main composing metal[.],

wherein said second portion of said connected member is outside of said resin.

New claims 18-25 have been added.